yield true and simple results within the sphere of logic, but it disclosed wonderful analogy between logical and mathematical forms, to which De Morgan adverts in the passage quoted above. All true progress in the philosophy of those fundamental sciences depends upon ever keeping in view the fundamental identity of the reasoning processes, as depending on the process of substitution, practised explicitly by algebraists for some two or three centuries past, and implied in the geometrical reasoning of Euclid.

But Mr. MacColl takes a backward step; he says he can make a simpler notation by taking $\alpha : \beta$ instead of my $\alpha = \alpha\beta$. In regard to form there is absolutely no novelty in the implication, for it is simply De Morgan's X)) Y, or the ancient Aristotelian proposition A is B. It is true that Mr. MacColl makes his terms consist of assertions, so that all his assertions would appear to be assertions about assertions—a needless complexity, landing us in the absurdity that a calculus of equivalent statements has no means of exhibiting the statements themselves. Mr. MacColl claims indeed considerable advantage for his notation on the ground that in the syllogism $(\alpha : \beta)\ (\beta : \gamma) : (\alpha : \gamma)$, the very same relation which connects α with β, and β with γ, connects also the combined premises $(\alpha : \beta)\ (\beta : \gamma)$ with the conclusion $\alpha : \gamma$. He thinks that my notation is very clumsy and roundabout, because, as my propositions treat of things or qualities, I should have to use words to express the inference of one proposition from others. In that case Mr. MacColl must bring the like charge of clumsiness against the whole body of mathematicians, because their equations are between things or their magnitudes, and they still use language "hence," "therefore," &c., to express the fact that certain equations lead to other equations. If there is any mathematical sign to denote inference, it is rarely used, unless it be the familiar ∵ and ∴, which are merely shorthand signs.

Mr. MacColl however, while pointing out the excellence of his implications, objects to my statement that he rejects equations in favour of implications on the ground that his method admits of both forms: "As a matter of fact," he says, "I employ both, sometimes even in the same problem. In my first paper . . . I adopt the equational form throughout; in my second and third papers, which relate entirely to questions of pure logic, I generally adopt the implicational form, as the simplest and most effective; while in my fourth paper, which treats of probability, I mainly adopt the equational form." There is nothing which I can see in this to contradict my objection that Mr. MacColl rejects equations *in favour of* implications. Mr. MacColl uses implications as "the simplest and most effective," but he adopts the equational form, I suppose, when he finds it indispensable; if not, why does he not hold to his simple and effective implication? If he finds one form best in logic and the other in mathematics, then he is ante-Boolian, because it was the whole point of Boole's labours to establish identity of method in logic and mathematics. I have really no wish to condemn Mr. MacColl's calculus or to enter into controversy with him, but in the interests of truth and sound science I must assert my belief that his implication $\alpha : \beta$ is at the best but a shorthand rendering of $\alpha = \alpha\beta$, which is Boole's form adopted by me. I have not said, and do not undertake to say, that Mr. MacColl's formulæ are not concise and neat. But a shorthand notation is bad if it obscures the real nature of the reasoning operation, and the fact that Mr. MacColl always keeps the equation in the background as a reserve method to call into operation when needed, shows to my mind that his methods are mistaken in a philosophical point of view. The very name of his method is "The Calculus of Equivalent Statements," and the word equivalent sufficiently implies that the equation is at the bottom of the matter. The end of it all then is that $\alpha : \beta$ has one letter less in it than $\alpha = \alpha\beta$, and to save the trouble of writing this one little letter Mr. MacColl would have us obscure all the grand and fertile analogies which Boole disclosed to the astonishment of mathematicians in 1847 and 1854. Mr. MacColl says: "The question whether the implication $\alpha : \beta$ or its equivalent the equation $\alpha = \alpha\beta$ should be preferred in a symbolical system of logic, must be decided on the broad grounds of practical convenience." It is not however a question of practical convenience, but of philosophical truth which is at issue, and in thus playing fast and loose with the equation, Mr. MacColl shows his entire want of comprehension of what is involved in the Boolian reform of logic. It may be added that were Mr. MacColl to discard implications and use only the equations which he admits are equivalent to them, there would be no formal difference between his calculus and that modified form of Boole's calculus which I proposed in 1864, and have been ever since engaged in developing, excepting indeed Mr. MacColl's unaccountable adoption of assertions as terms.

Perhaps it ought to be added that Boole, both in his "Mathematical Analysis of Logic," and in his great "Laws of Thought," introduces chapters on what he calls "Secondary Propositions" or Hypotheticals, which deal, like Mr. MacColl's assertions, with the truth of other assertions; but nothing emerges from Boole's discussion of secondary propositions except that they obey exactly the same formal laws as primary propositions, and are of course expressed equationally.

W. STANLEY JEVONS

ILLUSTRATIONS OF NEW OR RARE ANIMALS IN THE ZOOLOGICAL SOCIETY'S LIVING COLLECTION[1]

III.

THE animals we now speak of are again inhabitants of North-Eastern Asia—a country which, as before remarked, has of late years produced a considerable number of accessions to the list of Mammals. Both of them also belong to the great group of Ruminants—which is of special interest, as embracing all the animals upon the flesh of which civilised man principally subsists.

6. The Japanese Goat-Antelope (*Capricornis crispa*). For many years Siebold's "Fauna Japonica" was almost our only authority on Japanese zoology. The Dutch, having long had a monopoly of Japan, were enabled to stock their great National Museum at Leyden with a host of objects unknown to the other cabinets of Europe, but of which their travellers and residents managed to obtain specimens from various parts of the land where they only were permitted to penetrate. The "Fauna Japonica," although Japan is now open to all the world, still remains the best work of reference on the mammals of Japan. In it will be found the first description of the singular goat-like antelope of which the Zoological Society have recently obtained their first living example, drawn up by the celebrated naturalist Temminck, formerly director of the Leyden Museum. Temminck named the animal *Antelope crispa*, from the rough coat of hair which covers it, and tells us that it inhabits the higher alps of the Japanese Islands Nippon and Sikok, and is known to the Japanese as the "Nik." But a more complete account of its habits has lately been published by Capt. H. C. St. John in his recently-issued "Notes and Sketches from the Wild Coasts of Nipon." Capt. St. John tell us that the Japanese chamois, as he calls it, "is a very difficult animal to find, and to bag when found; they keep to the highest mountains, and to the highest and must rugged peaks of these ranges. I have hunted them with the natives, and with their dogs, and this often; and yet only once, although often close to the creatures, have I had a

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[1] Continued from p. 417.

glimpse of one, much less a shot. On one occasion I was lucky enough to see one, and this was by mere accident, and when not in search of game. I have often been told fabulous stories about the Nigou, the native name for this wary animal. They were supposed to have one horn, and to use this single frontal ornament as a means of hanging on to trees as well as in self-defence. After some years of anticipation and endeavour to get even a dead specimen, I got a couple, and then, strange to say, several others were brought to me. A young male, alive, was caught, after its mother was shot. Only one specimen of all that were brought to me by the native hunters had both their horns intact—always one, and often both, being more or less broken. In hunting them with dogs, it soon became evident why this was so generally the case. The Japanese, who knew the animal's habits intimately, invariably placed me near some huge bare slab of rock, on which the Nigou, when pressed by the dogs, was expected to appear, and on looking at these slippery sloping platforms, I tried to conjecture—when waiting for the animal to appear—where, if I knocked one over, it would tumble, and what shape or form it would be in by the time it stopped. I could then easily understand why the horns were usually so damaged.

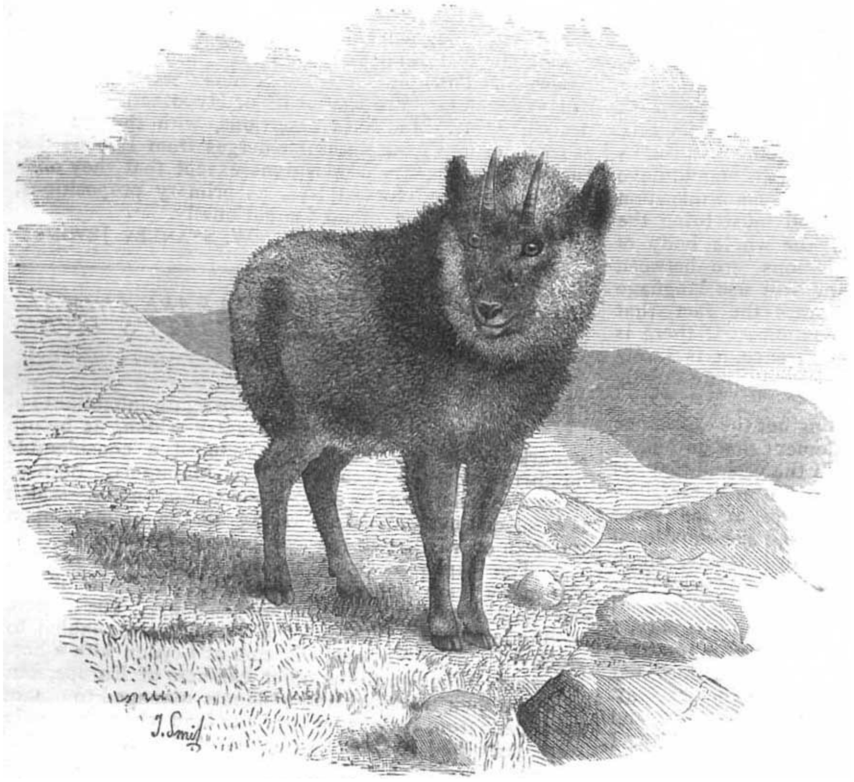

Fig. 6.—The Japanese Goat-Antelope.

"I have no doubt also they are often caught in the bushes or trees by the slightly turned-back horns, on their falling and reaching the foot of these rocks; hence the origin of the story of their holding on to the trees.

"The young one which was brought to me alive was the most fierce little thing I ever saw. Any dog, large or small, that approached its cage, down went its head, and with a quick sudden spring the creature invariably came bang up against the wooden bars. Its horns were about two inches long, as sharp as needles, and quite capable of inflicting a very nasty wound.

"The colour of the 'Nigou' is a brownish slate; the older they get the lighter-coloured they become. Until I actually had one in my hands, I was unable to decide whether they had a beard or not, and was pleased to find they do not possess this ornament—therefore they are true antelopes, and not goats."

For their unique specimens of this scarce animal the Zoological Society are greatly indebted to the energetic co-operation of one of their Corresponding Members, Mr. H. Pryer of Yokohama, Japan, by whom it was transmitted as a present to the Collection in April, 1879. The animal was then quite young, but has now attained full stature, and presents a very singular and characteristic appearance—quite different from that of either goats or antelopes—which is well shown in Mr. Smidt's drawing (Fig. 6).

The goat-like or mountain antelopes, to which the presents animal belongs, constitute a small group of the family Bovidæ, which is distributed over the mountain chains of Eastern Asia and its islands. The nearest geographical neighbours of the Japanese animal are *Capricornis Swinhoii* of Formosa, and *C. caudata* of China. In the Himalayas the genus is represented by *C. bubalina*—the Thaar or Tahir of Indian sportsmen, and in the higher ranges of Sumatra by *C. Sumatrensis*. In the Rocky Mountains of North America is found a far-separated member of the same group, which is known as the "Mountain Goat" by the American hunters (*Antilocapra Americana*). Our European Chamois (*Rupicapra tragus*) is not very distantly related to these animals.

7. Lühdorf's Deer (*Cervus Luehdorfi*).—The existence in North-Eastern Asia of a large deer of the same form as the North American "Wapiti" has long been known, although the animal has never been very clearly identified. By some authors it seems to have been referred to the Red-deer (*Cervus elephas*), by others to the Persian Deer (*C. Maral*), whilst the horns upon which the name *Cervus eustephanus* was founded by Blanford (in the Zoological Society's *Proceedings* for 1875) appear to belong to the same species. It is only quite recently however that examples of this fine animal have reached Europe alive, and its form and characters have become better known. In the autumn of 1876 two pairs of this deer were sent by Herr Lühdorf, the German Consul at Nicolajefsk, on the Pacific coast of Siberia, as a present to the Zoological Garden of Hamburg. They had been brought down the river Amoor from the far interior, having been obtained from some Nomads in the Bureati Steppe of Northern Mantschuria. The strangers throve well in their new quarters at Hamburg under the care of Director Bolau, and propagated their species. Several male fawns having been produced, one of them was parted with in exchange to our Zoological Society in London, and received in the Regent's Park in May last. From the specimen thus obtained, which is at present unique in this country, the accompanying illustration has been prepared.

It will be at once evident to those who are acquainted with the various forms of true deer, that the new stag from Amoorland is exceedingly like the Wapiti. The resemblance indeed of the two animals is so close that except for the character of the horns it would be exceedingly difficult to distinguish them. But so far as can be ascertained from an examination of the present specimens, which is now believed to be nearly four years old, and from the particulars given of other horns by Dr. Bolau in his description of the present animal,[1] Lühdorf's deer, as regards the character of its antlers, more nearly resembles our red deer than its American ally.

The discovery of a deer so closely allied to the Wapiti in Eastern Asia is a fact of special interest in geographical distribution. Taken in connection with other similar phenomena which have lately come to light, it tends to show very evidently that Northern America owes its many resemblances to the Palæarctic fauna, not to any former land connection between Europe and North America, as was formerly supposed by the advocates of the fabulous "Atlantis," but to a bygone extension of land between Eastern Asia and Western America. By some such passage there can be little doubt that the ancestors of the Wapiti, the American Bears, the Mountain Goat, and the Rocky Mountain Sheep found their way into the New World, to the more original fauna of which they have no sort of relationship.

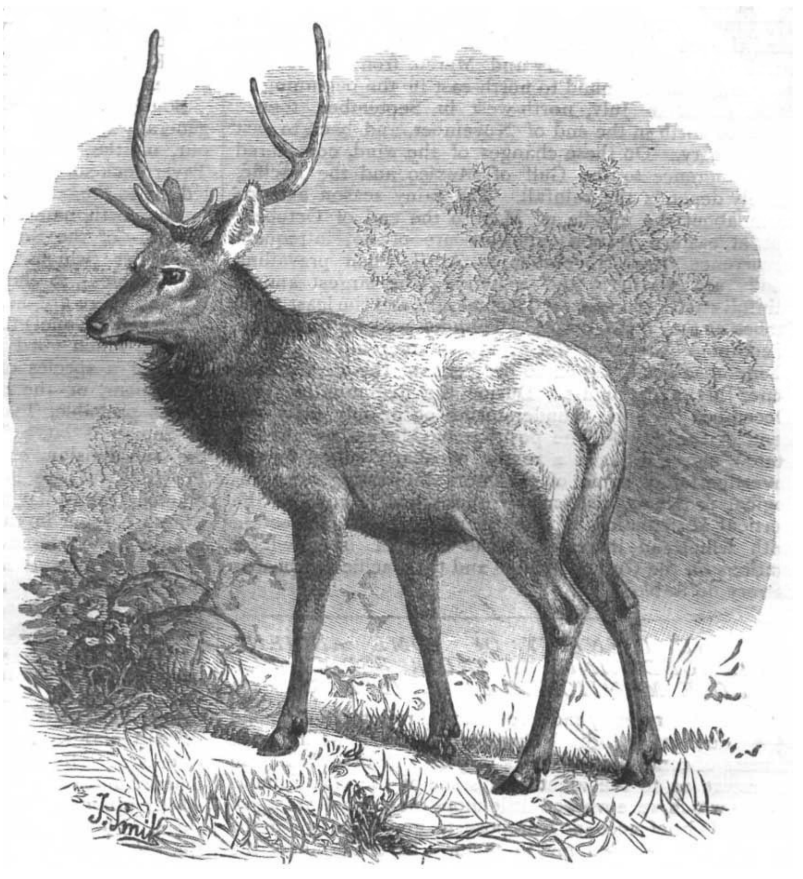

FIG. 7.—The Lühdorf's Deer.

METEOROLOGY IN MEXICO[2]

THE intertropical position of Mexico, on a high plateau between two continents and two vast oceans, renders the investigation of its meteorology peculiarly interesting. It is now more than four years since this problem was begun to be worked out with no little ability by the Mexican meteorologists, and, when the resources of the country are taken into account, with a spirit and liberality deserving of every commendation. This praise will not appear overstrained when we say that we have now before us for the city of Mexico a statement of the pressure, temperature, humidity, clouds, rainfall, direction and velocity of the wind, ozone, and other miscellaneous phenomena for every hour of the night as well as of the day, from March 6, 1877, down to October 16, 1880; and on the same sheet, in addition to the above, a daily statement of the chief meteorological elements for some thirty stations situated in various parts of Mexico, and at heights varying from 7 to 8189 feet above the sea. Annual *résumés* are also before us, that for 1879 having been received some time since.

During 1879 the mean atmospheric pressure at Tlacotalpam, situated near the sea and only 11 feet above it, was 29·938 inches, rising to the maximum, 30·075 inches in January, and falling to the minimum 29·851 inches in August. This seasonal distribution of the pressure holds good till the more elevated stations are reached, when pressure remains pretty constant during the year. This peculiarity becomes strongly marked at Zacatecas, the highest station, 8189 feet above the sea, where the January and July pressures are the same, and the lowest mean, that of March and August, falls only 0·016 inch below the annual mean, and the highest, that of November, rises only 0·024 inch above it. At all the stations the singular protrusion of a high pressure into the Atlantic and adjoining regions in the height of summer is represented in the means.

Of the greatest possible interest are the curves of the diurnal oscillations of the barometer, deduced from the hourly observations at the central station at Mexico, these curves being quite distinct, so far as we are aware, from the curves of any other intertropical place for which observations exist. The peculiarity lies in this, that while the morning maximum and the afternoon minimum remain large at all seasons, the morning minimum diminishes in amount as the summer advances; and during the strictly summer months it does not even fall so low as the daily mean. Now this is an outstanding peculiarity of the curves of diurnal pressure in the extratropical inland region of the great Europeo-Asiatic continent, and it becomes the more pronounced the more we advance into the interior of that continent. This result, viewed in connection with the other diurnal curves, forms a very valuable contribution to this difficult branch of the science.

The mean temperature for 1879 at Mexico, 7434 feet high, was 59°·5, May being the warmest month, 64°·6, and December and January the coldest, 55°·4; and these were generally the months of extreme temperature over the

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[1] *Abh. d. Nat. Vereins zu Hamburg*, 1880, p. 33.

[2] "Datos Meteorologicos: Resumen de las Observaçiones practicadas en varios Lugares de la República durante el Año de 1879." (Por el Ingeniero Civil V. Reyes. (Mexico, 1880.) "Boletin del Ministerio de Fomento de la República Mexicana." Tom. ii. iii., iv v.